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PROCESSING AND EXCHANGE OF DIGITAL BATHYMETRY(U)  
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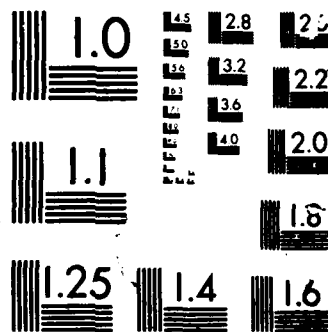
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# PROCESSING AND EXCHANGE OF DIGITAL BATHYMETRY

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## ABSTRACT

DMA is funding the software development for the Naval Oceanographic Office's Hydrographic Information Handling (HIHAN) System. This system will automate the processing and integration of bathymetric data from a variety of sources. These data will be formatted in the DMA Standard Linear Format (SLF) to allow direct entry into the DMA hydrographic data base. Further, SLF is compatible with the proposed International Hydrographic Office (IHO) Committee on the Exchange of Digital Data (CEDD) International Standard. Support of the CEDD format will facilitate the exchange of digital bathymetric and charting data between hydrographic offices.

## INTRODUCTION

The Defense Mapping Agency (DMA) has the threefold mission of production and worldwide distribution of mapping, charting and geodetic (MC&G) products for the Department of Defense (DoD) and the Merchant Marine; DoD advisor on MC&G matters; and management of all DoD MC&G resources. An important element of this mission is the production of hydrographic charts in support of a wide spectrum of military and civilian requirements. Data collection (including technical equipment operation and maintenance) remains a Navy responsibility and is exercised by the Naval Oceanographic Office (NAVOCEANO). At present, utilizing data collected by existing Navy survey assets, the DMA faces a backlog of over a century in coastal hydrographic survey requirements. A critical need exists for the development of cost-effective data collection systems that can cover large areas rapidly. Likewise, the modernization of the extensive manual data processing techniques currently used is required. This is particularly true with respect to the generation of digital smooth sheets. Working through the Naval Ocean Research and Development Activity (NORDA), the Navy's designated laboratory for MC&G RDT&E, DMA is taking steps to develop the necessary systems and automated processing techniques to meet the challenge.

Internal to DMA, the Scientific Data Department (SD) at the Defense Mapping Agency Hydrographic/Topographic Center (DMAHTC) has the responsibility for the collection, storage and retrieval of bathymetric data for the Department of Defense. In addition to the collection of data from Navy sources, SD actively pursues the collection of sounding data such as ships at sea, oil company surveys and foreign data provided through exchange agreements. SD maintains a digital Bathymetric Data Base and a corresponding means to digitize analog data called the Bathymetric Data Reduction System (BDRS). The BDB and the BDRS have been in place since

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the 1970's and have exceeded their intended life cycles. SD has initiated action to enhance the software capabilities of the BDB and automate the bathymetric data evaluation procedures.

#### HIHAN

The existing system for reduction and evaluation of sounding data is manually oriented and labor intensive. Many of the functions initially performed aboard ship are duplicated in-house as part of the verification process. The development of the Hydrographic Information Handling System (HIHAN) by NORDA and NAVOCEANO, with software funding from DMA, will automate the preprocessing, integration, and preparation of hydrographic data from a variety of sources such as ships and the Airborne Bathymetric System (Laser Sounder, Multispectral Scanner and Electromagnetic Bathymeter) (Byrnes, et al, 1983). Designed to be expandable so that future developments may be incorporated, HIHAN will provide a data tape containing all of the necessary information for the generation of hydrographic smooth sheets formatted in SLF and utilizing the Feature Attribute Coding Standard (FACS). The system will provide the hydrographer with an interactive graphics editor which can display portions of field sheets, depth contour plots, and vessel tracks for user defined areas (Mapp, 1986). The planner will have an interactive graphics package allowing him to input digitized historical documents and construct base maps for layout of vessel tracks, navaid sites, and tide and sound velocity stations. In general, survey data consists of large numbers of short records containing timetagged navigation and depth measurements. These records must be stored in such a way to ensure fast sequential access, fast keyed access, and the ability to insert, delete, or modify any record in the file. Indexes to sounding data and cartographic feature data will be stored in a relational data base. Cartographic feature data, which includes shorelines and historical soundings, is also stored. The pay off to DMA will be the receipt of data in a digital smooth sheet thus avoiding the manual digitization now required. The tape will include a variety of features such as current and tidal stations, aids to navigation shorelines, depths and hazards to navigation. Scheduled for delivery in FY 87/88, HIHAN will employ electronic display and storage techniques, software manipulation, statistical evaluation, and human-engineered interfaces. The information generated will be formatted to allow direct entry into the DMA hydrographic data base.

#### BATHYMETRIC INFORMATION SYSTEM

The Bathymetric Information System (BIS) is composed of 4 interactive components to efficiently process, evaluate, store and retrieve bathymetric data. The proposed operational concept contains the following system components:

- a. Bathymetric Data Base (BDB) - a menu-driven system for the storage of digital bathymetric data by geographic coordinates. The data base will have a growth potential to exceed 75 million data points and

will provide reliable access and a interactive query and editing capability. The BDB will be capable of receiving and outputting data in SLF and the proposed CEDD format to facilitate not only internal use, but the external exchange of digital data between hydrographic offices.

b. Bathymetric Index Data Base (BIDB) - will contain all the bathymetric source information and geographic portrayal in a centralized, on-line data base linked to the BDB by a communications line. A graphic terminal will enable the user to query the system by geographic coordinates and produce a plot of the survey areas, tracks and discrete points. Textual information such as ship name, navigational aids, and data evaluation information is also available.

c. Bathymetric Evaluation System (BES) - will allow interactive display of incoming bathymetry directly against current raw data holdings, or against a refined gridded bathymetric data base. Interactive displays will be in the form of contours, discrete points, gridded points, and/or all of the above. Utilizing color separated contours and statistical outputs the BES will allow the cartographer to interpret the integrity of incoming raw data. Upon evaluation, new raw data and updated grids will be incorporated into the current BDB holdings and gridded bathymetric data base respectively.

d. BIS Micro-Digitizers - two digitizing stations for the processing of hardcopy bathymetric data. The data will be temporarily stored on a floppy disk and then transmitted over a communications link to the BDB when digitization of the chart/plot is complete. Each station has a small graphics plotter for proofing the digitized files.

#### EXCHANGE OF DIGITAL DATA

In May 1983, the International Hydrographic Bureau (IHB) created the Committee on the Exchange of Digital Data (CEDD). IHB Circular Letter 20/1983 identified fifteen IHO member nations, including the United States, which would make up the committee. The original goal of the committee was to explore (a) the appropriate medium of exchange of digital data, and (b) the feasibility and problems of such an exchange. In January 1985, the IHB further directed the CEDD to consider the needs of electronic charting in the development of the exchange format. In late 1986, the membership voted unanimously to submit at the XIIIth International Hydrographic Conference in May 1987, a CEDD developed format for adoption as an international standard for the exchange of digital hydrographic and charting data. The proposed format accommodates the two data structures in common use today, sequential and chain-node, and is upwardly compatible with the more advanced data structures, including those supporting topologic relationships. Thus the upward mobility and flexibility built into the format assures its ability to support both digital data exchange and electronic charting.

### SUMMARY

DMA is addressing a program to support the population of a comprehensive bathymetric data base. The program is being designed to provide an end-to-end approach beginning with data collection, processing and evaluation, assimilation, and ending with digital smooth sheet generation. Throughout, the emphasis is on automation and the generation of digital data capable of being efficiently utilized in chart production and easily exchanged between hydrographic offices or provided to electronic chart system developers.

### REFERENCES

1. J. Byrnes, et al, "Hydrographic Information Handling System (HIHAN) Concept Development", NORDA Report, March 1983.
2. G. Mapp. "A Data Management Scheme for Procesing Hydrographic Data", DoD MC&G Conference, October 1986.

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